

Chem 101, Day 1

What is chemistry?

Chemistry is the "study of change/matter." Often called the "central science." Fritz Haber won the Nobel Prize for learning to produce ammonia (the Haber-Bosch Process). Sam Kean's "the disappearing spoon" = stories of interesting chemists.

Atoms, Molecules, and ions

J.J. Thomson experimented with cathode ray tubes. Using a magnet, discovered that the ray is negative and has mass (deflected by negative end, attracted to positive end, could turn a paddle wheel). Discovered **electrons**. Discovered the charge to mass ratio of electrons.

Millikan devised an experiment to discover the mass of an individual electron using the Oil Drop Experiment. Discovered the charge of an electron and therefore mass (charge-mass ratio)

Rutherford used **alpha particles** (large, positive particles) directed at a thin gold foil. Almost all passed through, some bounced back or deflected. Discovers space between atoms and a positive dense center (nucleus). Electrons outside of the nucleus.

Electron (e⁻) (relative mass of 0 amu (atomic mass unit), charge of -1)

Proton (p⁺) (relative mass of 1 amu, charge of 1)

Neutron (n) (relative mass of 1, charge of 0)

Elements differ by number of protons in the nucleus (**atomic number** = number of protons)

Mass number = number of protons and neutrons.

Atomic Symbols: superscript = Mass number, subscript = Atomic number. Can also be written with just the mass number (C-12)

Isotopes = atoms of the same element with different number of neutrons and therefore different masses. Isotopes of hydrogen: protium (1 proton and no neutrons; mass number 1), deuterium (1 proton and one neutron; mass number 2), tritium (1 proton and 2 neutrons; mass number 3). Isotopes of carbon: carbon-12 (6 protons and 6 neutrons) and carbon-14 (6 protons and 8 neutrons).

Atomic Weight (atomic mass) of an element is the weighted average of all isotopes present in nature. Atoms are too small for grams so amu (atomic mass units) are used.

Atomic mass = (percent abundance of isotope 1 x mass of isotope 1) + (percent abundance of isotope 2 x mass of isotope 2)